

Improved Productivity of Document Verification Process Using the Lean Sigma Method

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ABSTRACT

In the industrial era 4.0 emerged smart companies using the concept of automation and digitization. This has had an impact on printing companies which are experiencing a decline in the global rate of newspaper growth in the next five years. Therefore, many companies conduct Improvement and Innovation activities and eliminate waste in order to continue to survive and be able to compete. This research aims to identify the types of waste that occur in the flow of the process of activities, analyze the factors that cause waste, as well as provide proposals for minimizing waste. The method used in this study is lean sigma which is a combination of lean and six sigma to identify and eliminate waste in an effort to improve the continuous improvement process. In this study conducted with Define, Measure, Analyze, Improve, and Control (DMAIC) stage in accordance with the steps in Six Sigma. This research is focused on improving the productivity of continuous improvement verification process with lean sigma method.

Keywords: lean sigma; DMAIC; productivity; wastage

INTRODUCTION

An industry must make continuous improvements to be able to continuously compete [1]. By making continuous improvements or commonly called Continuous Improvement (CI), it is expected that each employee gives each other improvements to support the company's growth and survival. The importance of continuous improvement in every aspect of impact helps the growth of the company as well as employees.

With employees making CI, continuous improvement officers (CIO) must also be fast and precise in verifying this. The level of productivity achieved by the company is an indicator that shows how efficient the company is in combining the resources in its company. Therefore, productivity is important to know all parties that produce output by using inputs as support [2]. This is also felt in printing companies located in the Area of Cikarang. The number of prints each year decreases from 8% - 15%. This research conducted observations using Define, Measure, Analyze, Improve, Control (DMAIC). DMAIC is one of the stages used in the quality improvement method which is Six Sigma. Six Sigma is a method used to reduce errors or defects in the process based on data.

WHAT IS LEAN MANUFACTURING?

Lean manufacturing can be defined as a systemic and systematic approach to identify and eliminate waste (waste) or activities that are not value-adding through a radical CI by flowing products (materials, work in process, output) and information using pull systems from internal and external customers to pursue excellence and perfection in the manufacturing industry. In this regard, waste can be defined as any work activity that does not provide added value in the process of transforming inputs into outputs along the value stream.

Toyota has been a pioneer in the lean system, which is a type of waste that needs to be considered when the lean system is implemented. This is termed "seven plus one" type of waste according to Toyota.

WHAT IS SIX SIGMA?

Sigma is a Greek alphabet that shows the standard deviation of a process. Standard deviation measures the variation or number of distributions of a process average. Sigma values can be interpreted as how often defects may occur. The higher the sigma level, the less tolerance given to defects, the higher the process capability, and it is said to be the better [3].

Six Sigma is also defined as a set of tools appointed in quality management that build a framework that complies with the standards for the repair process [4].

What are the advantages of six sigma?

The benefits of Six Sigma could be seen as follows [5]:

- 1) Producing sustainable success: Sustainable success is the only way to maintain the company's growth and still master the safest market through continuous innovation.
- 2) Setting performance goals for everyone: A company should be able to make everyone work in the same direction and focus on one common goal. Six Sigma uses a shared business framework to ensure everyone in the organization works in the same direction.
- 3) Strengthening value to customers with intense competition in every industry: The delivery of products and services that are "Good" or "Disability Free" does not guarantee a success. Customer focus is at the heart of Six Sigma.

- 4) Accelerate the repair rate of competitors: The fastest repair is most likely to win the market. Six Sigma helps a company to not only improve performance, but also accelerate improvements.
- 5) Promoting Six Sigma learning is an approach that can improve and accelerate the development and dissemination of new ideas of an organization as a whole.
- 6) Change strategy by introducing new products, launching cooperation, entering new markets and cooperating with new organizations.

WHAT IS DEFINE, MEASURE, ANALYZE, IMPROVE, CONTROL (DMAIC)?

Six Sigma is a method of quality improvement implemented by Motorola Company in 1986. The target of Six Sigma is to increase the quality to 93.4 defects per million opportunities (DPMO) for each product in the form of goods or services in an effort to reduce the number of defects [6].

In applying Six Sigma, comprehensive and structured stages should be involved, and should be based on numerical data, otherwise known as a structured method. DMAIC is commonly used in product or process improvement, where the product or process already exists but no longer meets customer needs [7]. DMAIC is a stage used in the Six Sigma method. Six Sigma itself is one of the methods used to make quality improvements. DMAIC is a structured problem-solving method that each stage is done based on the previous stage and aims to implement long-term solutions to existing problems [8].

What are the elements in the verification process?

The following is an explanation of the elements of the verification process:

1. Title improvement checks in Excel: The CIO must verify whether the incoming Innovation Report (IR) is a duplicate or not.
2. Search for paper improvement according to the title in Excel.
3. Checking the new IR when entered with the old one: After the report has been obtained, the CIO conducts a check to the content in it whether the new Improvement is a duplication of the old Improvement.
4. Enter IR data.

Identification of waste on work activities in the verification process

TABLE 1: Comparison of Verification Process Activities

BEFORE		AFTER	
1	Title Improvement Checking at data Excel	1	Checking Titles in Web Application Knowledge Management
2	Search for paper improvement according to title in Excel	2	Check out the new innovation report with the one using Knowledge Management application
3	Checking the innovation report just entered with the old one	3	Enter innovation report data
4	Enter innovation report data		

As can be seen from Table 1, prior to making improvements, there were 4 working elements. These elements are reduced to 3 processes. The decision of the verification process can be made shorter judging by the reduced working elements. The deleted work element is to search for the Improvement paper according to the title in Excel and replaced by checking the new IR entered with the old one using the Knowledge Management Application.

HOW DOES THE “DEFINE” STEP WORK?

The Define stage is done to identify the themes that will be improved and ensure that they can be in line with the objectives of the organization and have an impact. The following are the steps taken at the define stage:

- 1) Project Charter
- 2) SIPOC

What is project charter?

Project charter explains general information relating to the verification process so that it can fit the business objectives. There are several elements in project charter, such as Project Overview, Project Description, Problem Statement, Project Objective, Project Benefit and Project Scope.

- 1) Problem Statement: Continuous Improvement verification process is high by 39 minutes and productivity achievement is raised by 43%.
- 2) Project Scope: Scope of implementation of verification process activities for all IRs, as carried out by the CIO.
- 3) Key Performance Indicator, KPI: The standard time of the verification process is 39 minutes with a target of 27 minutes obtained from a decrease of 30% from the previous time.
- 4) Business Impact: In addition to shortening the verification time, the impact of this study is to reduce costs by Rp 4,949, -/ IR. Calculated from the difference between the actual time and target of 12 minutes, then multiplied by the hourly CIO salary of Rp 24,553, -. In comparison with 2019 IR, which is similar to 2018 IR, the saving cost is Rp 1.079.058, -.
- 5) Project Plan: This research starts from January 20, 2020 to April 30, 2020.
- 6) Team Selection: Team selection consists of project leader, project champion, project sponsor, F&A Representative and core Team members.

What is SIPOC?

Suppliers, Inputs, Process, Outputs and Customer (SIPOC) charts are used to briefly describe the Improvement verification process as well as limitations. To make it easier to identify customers and their needs, know the process and know what inputs are needed. Here, we present SIPOC chart from supplier elements to customers.

TABLE 2: SIPOC Chart

Suppliers	Inputs	Process	Outputs	Customer
Innovator all Department	Report Improvement	Verification	Verification Result & Data	CIO
Innovator all Department	Report Improvement	Verification	Reward	Innovator

HOW DOES THE “MEASURE” STEP WORK?

Once the theme of the project is decided, the next step is to determine the size of the success of the project. Starting from the verification process flow until the collection of verification process time data using the stop hours method.

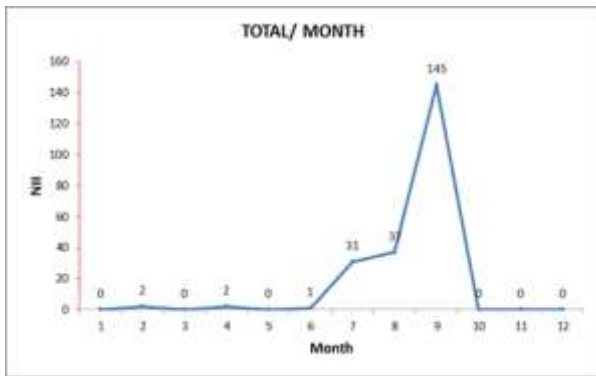


FIGURE 1: Trend Verification Improvement in 2019

As can be seen from Fig 1 graphic, in the 9th month or September there was an increase in IR reporting. This is where the Improvement program is done on a yearly basis, and where it closes. Often spikes occur at the time of H-6 Closing day. So, the verification process is not done to the maximum and there are some improvements that must be done to enter the following year.

HOW DOES THE “ANALYZE” STEP WORK?

The main objective in this analysis phase is to determine the root cause of the verification process. This step uses the Fishbone and 5W1H tools.

What is fishbone?

The basic function of the Fishbone diagram is to identify and organize the possible causes of a specific effect and then separate the root causes. After identifying and organizing the causes using Fishbone, the results obtained are:

- Man Power category: where the problem is only 1 vericator/ CIO available.
- Method category: where the problem is manual verification process.
- Machine category: where the problem is no special place or specific application to store the data in the data base.
- Material category: where the problem is the ease of breaking the document.

The root of the problem of high verification process time is that there is no specific application for Improvement verification. To ensure the result of Fishbone, 5W method is added.

What is 5W1H?

The 5W+1H method here is used to amplify the results of Fishbone. With the problem is a high verification process time of up to 39 minutes. Here’s a look up of the root cause using the 5W+1H method.

TABLE 3: Analysis 5W + 1H

5W + 1H Analysis			
NO	Questions		Answer
1	What	What is going on?	Improvement verification process time 39 minutes
2	Where	Where is the problem happened?	In the improvement verification process
3	When	When does the problem occur?	During the improvement program from January to September
4	Why	Why does the problem occur?	Because there is no specific application for improvement verification
5	Who	Who did it?	CIO

In this analysis stage, researchers draw conclusions that the root of the problem from the time of high verification is due to the lack of special applications to shorten the verification process.

HOW DOES THE “IMPROVE” STEP WORK?

The root cause of the problem occurs in the absence of a special application to help shorten the verification process. Furthermore, in the Improve stage, improvements to the root of the known problem are made. With the help of Brainstorming Tools & Solution selection matrix, it is expected that innovative and targeted solutions can be provided to achieve maximum results.

What is brainstorming?

Brainstorming gather ideas that will be an improvement to the problem of high verification process time. Below in Table 4 are the results of Brainstorming.

TABLE 4: Brainstorming Results for Improvement Ideas

No	Type of Option Improvement
1	Change improvement method to paperless digital
2	Create a new app for improvement
3	Developing web application Knowledge Management

What is solution selection matrix?

In solution selection matrix, assessment of incoming ideas is conducted. There are 2 points considered, namely Cost and Benefit. The results of assessment using solution selection matrix includes:

- 1) Converting Improvement methods to paperless digital.
- 2) Creating a new app for Improvement.
- 3) Developing a Knowledge Management Web Application.

TABLE 5: Solution Selection Matrix Results

No	Repair Option Type	Cost	Benefit	Index	Type
1	Change improvement method to paperless digital	4	5	4.8	Extra Earning
2	Create a new application for improvement	3	4	3.8	Extra Earning
3	Develop knowledge management web application	1	4	3.4	Grand Slam

The result is that the operator will take a solution with a Type Grand Slam which means that the solution is highly recommended to be implemented. The improvement that will be implemented is to develop a Knowledge Management Application.

HOW DOES THE “CONTROL” STEP WORK?

The Control stage ensures that the improvements made are on target by evaluating the benchmarks. If there has been an increase compared to before the project, it is necessary to standardize and socialize to get a wider impact.

- 1) PICA: Problem Identification and Corrective Action (PICA) is a simple tool that shows the problem that occurs in detail. In general, PICA is used to know the problems after repair and obtained to plan repairs.
- 2) Default Time Calculation Verification Process After the Improve stage: This section can be divided into three:
 - a) Cycle Time Recapitulation: Here, a recapitulation of the cycle time of the verification process after making the repair is presented.

TABLE 6: Verification Process Cycle Time After Improvement

Average Processing Time (Seconds)			WS (Seconds)
a	b	c	
251.47	357.3	172.17	780.93

b) Calculating Normal Time: An example of a Normal Time calculation for a Type of Improvement Verification job is as follows:

TABLE 7: Adjustment Factor

No	Work	Adjustment Factor (P)
1	Verification Improvement	+0,08

NT = ST x (1+P)
 NT = 780.93 x (1+0,08)
 NT = 843.41 seconds

c) Calculating Default Time

TABLE 8: Allowances Factor

Factor	Range (%)	Losseness (%)	Information
The Power Issued	0,0 - 6,0	6	Work at desk, sit down, but occasionally standing with a frequency that is not often
Work Attitude	1,0 - 2,5	1	Upright body two feed focused
Work Movement	0	0	Normal, unlimited
Eye Fatigue	0,0 - 6,0	0	Intermittent views due to alternately view computers and physical data with unusual frequency
State of the place work	0 - 5	0	Normal temperature with a temperature of 22 - 28 °C
Atmospheric Conditions	0	0	Well ventilated room, cool air
Condition milieu	0	0	Clean, healthy, bright, low noise
Personal Needs	0 - 5	4	
Σ		0.11	

The following is an example of a Standard Time calculation for the Type of Improvement Verification job after repair:
 DT = NT x (1 + P)
 DT = 780.93 x (1 + 11%)
 DT = 936.18 seconds
 DT = 15.60 Minutes

3) Productivity of the verification process: After making improvements, the operator recalculates productivity after repair. Productivity calculations can be seen below:

$$Productivity = \frac{Output}{Input} \times 100$$

$$Productivity = \frac{1642.01 - 936.18}{1642.01} \times 100$$

$$Productivity = 42.9\%$$

When compared to the standard or target of 27 minutes productivity results increased by 42.9 from the specified target. But compared to the difference from the time before that of 39 minutes, the result was a decrease of 86% from the previous data. So that the standard time can be changed because the results of the calculation of time obtained can exceed the standard time.

4) Poka Yoke: Researchers include its application in making Standard Operating Procedure (SOP) with the aim of reducing the occurrence of errors in the verification process for the guidelines of verifiers.

VERIFICATION TIME DATA COMPARISON

The DMAIC method can recalculate the verification time after performing the following repair calculation of the default time of the verification time before the repair and after the repair.

TABLE 9: Verification Time comparison Before and After

BEFORE		AFTER	
Process Elements	Total Time (seconds)	Process Elements	Total Time (seconds)
1	288.43	1	251.47
2	1239.40	2	357.30
3	256.93	3	172.17
4	171.97		
Total	1956.73	Total	780.93

The time after repairing is in the process 1 average - the average time is 251 seconds, process 2 average time 357.30 seconds and in process 3 the average time obtained is 172.17 with a total time of 780.93. It appears that the verification process has decreased from 1956.73 seconds to 780.93 seconds.

STANDARD DEVIATION CALCULATION (σ)

Standard deviation calculation serves to know the value of the spread of verification data. Here is the standard deviation table before and after repair:

TABLE 10: Standard Deviation Before and After

BEFORE		AFTER	
Process Elements	Total Time (seconds)	Process Elements	Total Time (seconds)
1	37.52	1	32.72
2	81.66	2	33.29
3	48.92	3	12.98
4	14.36		
Total	60.54	Total	42.04

CYCLE TIME RECAPTULATION

TABLE 11: Verification Process Cycle Time

BEFORE		AFTER	
Process Elements	Total Time (seconds)	Process Elements	Total Time (seconds)
1	288.43	1	251.47
2	1239.40	2	357.30
3	256.93	3	172.17
4	171.97		
Total	1956.73	Total	780.93

Found from the calculation results are:

- Process element a with Title Checking process in Web Application Knowledge Management of 251.47 seconds.
- Process element b with the new Check Innovation report process coming in with the old one at 357.30 seconds.

- Process element c with Process Input Innovation Reports data is 172.17 seconds.
- With a total time of 780.93seconds or equal to 13.01 minutes.

CALCULATING NORMAL AND STANDARD TIME

TABLE 12: Normal Time and Default Time

	BEFORE	AFTER
Normal Time	2113.27	843.41
Default Time	39.09	936.41

After calculating the cycle time, normal time and default time of results obtained is the default time of Improvement verification which is 936.41 seconds or equal to 15.61 minutes. It can be concluded that the verification process time becomes shorter with an initial 39 minutes and after making repairs to 15.61 minutes. The calculation of adjustment time and Allowance is the same as the data before the repair.

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